

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1 1. (Currently amended): An allocation method for allocating a plurality of
2 logical volumes to form a plurality of virtual volumes among a plurality of virtualization
3 apparatuses, the virtualization apparatuses being coupled to a plurality of host computers and to a
4 storage device, the logical volumes related to at least one disk drive in the storage device, the
5 virtual volumes processing input-output requests from the host computers, the method
6 comprising steps of:~~a storage area of a storage device to a virtual volume in a storage system~~
7 ~~having a plurality of virtualization apparatuses that allocate the storage area which the storage~~
8 ~~device has, form a plurality of virtual volumes, and process input-output from a host processor to~~
9 ~~one of the virtual volumes, comprising the steps of:~~
10 issuing, to the plurality of virtualization apparatuses, a request for completing all
11 ~~the input-output requests received from the host processors that are~~ being processed by the
12 ~~virtualization apparatuses received from the host processor and temporarily holding the any~~
13 ~~subsequent input-output requests received from the host processors processing that is received~~
14 ~~subsequently;~~
15 receiving, from the plurality of virtualization apparatuses, a completion report of
16 the input-output ~~requests processing~~ being processed by the virtualization apparatuses in
17 response to the request for completing;
18 sending an instruction of an allocation change of logical volumes~~the storage area~~
19 ~~of the storage device~~ to all the virtualization apparatuses when upon receiving the completion
20 reports from all the virtualization apparatuses to which the request for completing was issued;
21 receiving ~~the a~~ completion report of the allocation change from all the
22 virtualization apparatuses; and

23 sending an instruction ~~for releasing a state of the input-output held temporarily to~~
24 all the virtualization apparatuses for releasing the input-output request that are being temporarily
25 held.

1 2. (Currently amended): An allocation method ~~for a storage area~~ according
2 to claim 1, wherein a table storing configuration information that associates the virtual volume
3 with the logical volumes~~storage area~~ that becomes a real area of the storage device is prepared in
4 a memory in advance, and
5 when ~~an~~the instruction of the ~~an~~ allocation change of the ~~storage area~~ is sent,
6 difference information of the configuration information is sent, and the virtualization apparatus
7 changes the configuration information on a relevant entry of the table.

1 3. (Currently amended): An allocation method ~~for a storage area~~ according
2 to claim 1, wherein ~~the a~~ virtualization apparatus that did not ~~receive the~~send its completion
3 report of ~~the input-output processing~~ is removed from a control range and the allocation of ~~the~~
4 ~~storage area~~its logical volumes is not changed.

1 4. (Currently amended): An allocation method ~~for a storage area~~ according
2 to claim 1, wherein whether ~~the a~~ subsequently received input-output request is held temporarily
3 or not is controlled aiming at an address range including a location where the allocation is
4 changed on the virtual volume.

1 5. (Currently amended): An allocation method ~~for a storage area~~ according
2 to claim 1, further comprising, for a virtual volume with newly allocated logical volumes,
3 copying data from logical volumes previously allocated to the virtual volume to the newly
4 allocated logical volumes. ~~the step of copying data to the storage area of the storage device to~~
5 ~~which the virtual volume is newly allocated from the storage area of the storage device to which~~
6 ~~the virtual volume has already been allocated before the instruction of the allocation change of~~
7 ~~the storage area is sent.~~

1 6. (Currently amended): A storage system, comprising:
2 a storage device that can specify a plurality of logical volumes~~storage areas~~;
3 a plurality of virtualization apparatuses that allocate ~~a storage area which the~~
4 ~~storage device has, the~~ logical volumes to form a plurality of virtual volumes, and to process
5 input-output requests sent from a plurality of host processors to one of the virtual volumes; and
6 a configuration change controller for changing an allocation configuration of the
7 logical volumes~~storage area of the storage device~~ to the virtual volumes, wherein
8 the configuration change controller includes:
9 means for requesting temporary hold of ~~the~~ input-output requests to ~~all the~~
10 virtualization apparatuses,
11 the virtualization apparatus that received the request includes:
12 means for completing ~~the all~~ input-output requests received from the host
13 processors that are being processed by the virtualization apparatus, shifting to a state of
14 temporarily holding ~~an~~ subsequently received input-output request from ~~a the~~ host processors
15 subsequently, and returning a completion report of processing of the input-output requests
16 ~~processing~~ to the configuration change controller, and
17 the configuration change controller includes:
18 means for instructing an allocation change of the logical volumes~~storage area of~~
19 ~~the storage device~~ to the virtual volume to the virtualization apparatus when receiving the
20 completion report from all the virtualization apparatuses to which a request was issued.

1 7. (Currently amended): A storage system according to claim 6, wherein
2 the configuration change controller includes:
3 a configuration change control program that includes the request means, means
4 for receiving the completion report from the virtualization apparatus, and the change instruction
5 means;
6 a processor that executes the configuration change control program;
7 a memory that stores a configuration information table registering configuration
8 information that associates the virtual volume with the logical volumes ~~storage area~~ that becomes

9 a real area of the storage device and a difference information table recording a difference before
10 and after the change of the configuration information,
11 the virtualization apparatus, includes:
12 a configuration management program that performs processing of a configuration
13 change;
14 a processor that executes the configuration management program; and
15 a memory that stores a configuration information table registering the
16 configuration information that associates the virtual volume with the logical volumes storage
17 ~~area~~ that becomes the real area of the storage device and a difference information table recording
18 the difference before and after the change of the configuration information, and
19 the configuration change controller sends the difference information of the
20 configuration information to the virtualization apparatus with reference to the difference
21 information table when sending the instruction of the allocation change of the logical
22 volumes storage area, and the virtualization apparatus executes the configuration management
23 program by the processor and changes the configuration information of a relevant entry of its
24 own the configuration information table in accordance with the received difference information.

1 8. (Original): A storage system according to claim 6, further including a
2 management console comprised of an input unit that inputs a request of the change of the
3 configuration information to the configuration change controller and a display unit that displays
4 a status of the configuration change.

1 9. (Currently amended): A virtualization apparatus that allocates ~~a storage~~
2 ~~area which~~ logical volumes of a storage device ~~has~~, forms a plurality of virtual volumes from the
3 logical volumes, and processes input-output request sent from a plurality of host processors to
4 one of the virtual volumes, comprising:
5 a configuration change control program for changing a configuration of
6 associating the virtual volume with the storage area that becomes a real area of the storage
7 device; and
8 a first processor that executes the configuration change control program, wherein

9 the program includes:
10 means for requesting an input-output request temporary hold to another
11 virtualization apparatus before changing the configuration of associating the virtual volume with
12 the logical volumes~~storage area~~ that becomes the real area of the storage device;
13 means for allowing the other virtualization apparatus that received the request to
14 complete ~~the all~~ input-output requests received from that host processors that are being
15 processed, ~~subsequently shifting~~ to a state of temporarily holding ~~an subsequently received~~
16 input-output requests ~~from a the~~ host processors, and returning a completion report;
17 means for instructing, to the other virtualization apparatus, an allocation change
18 of the logical volumes ~~storage area of the storage device~~ to the virtual volume when receiving the
19 completion report from the other virtualization apparatus;
20 means for receiving the completion report of the allocation change from the other
21 virtualization apparatus; and
22 means for sending an instruction ~~for releasing the state of the input-output held~~
23 temporarily to the other virtualization apparatus for releasing the input-output request that are
24 being temporarily held.

1 10. (Currently amended): A virtualization apparatus according to claim 9,
2 further comprising:
3 a memory storing a configuration information table registering configuration
4 information that associates the virtual volume with the logical volumes~~storage area~~ that becomes
5 the real area of the storage device and a difference information table that records a difference
6 before and after a change of the configuration information;
7 a configuration management program for receiving a request from the
8 configuration change control program to temporarily hold changing input-output requests and
9 change configuration information; and
10 a second processor that executes the configuration management program, wherein
11 contents of the configuration information table are updated by executing the
12 configuration management program by the second processor.

1 11. (Original): A virtualization apparatus according to claim 10, wherein the
2 first processor and the second processor are comprised of the same processor.

1 12. (Original): A virtualization apparatus according to claim 9, wherein the
2 configuration change control program further comprises means for performing arbitration
3 processing to limit the first processor that executes the respective means of the configuration
4 change control program.

1 13. (Original): A virtualization apparatus according to claim 10, wherein the
2 configuration information table comprised of a plurality of faces is prepared and a table of each
3 face is switched.

1 14. (Currently amended): A virtualization apparatus according to claims 9,
2 further comprising:
3 when changing a configuration from the logical volumes ~~one storage area~~ to
4 which the virtual volume corresponds to another storage area,
5 a copy processing program for copying and processing data to the other logical
6 volumes ~~storage area~~; and
7 a copy progress table that manages a progress status of the copy processing of the
8 data using the copy processing program.

1 15. (Currently amended): A storage device comprising a plurality of ~~storage~~
2 ~~areas~~ logical volumes for providing a real storage area and a virtualization apparatus that
3 allocates the logical volumes ~~storage areas~~, forms a plurality of virtual volumes, and processes
4 input-output requests from a plurality of host processors to one of the virtual volumes, wherein
5 the virtualization apparatus includes:
6 means for requesting an input-output temporary hold to another virtualization
7 apparatus before changing a configuration of associating the virtual volume with the logical
8 volumes ~~storage area~~ that becomes a real area of the storage device;

9 means for allowing the other virtualization apparatus that received the request to
10 complete ~~the all~~ input-output requests received from the host processors that are being processed,
11 subsequently-shifting to a state of temporarily holding ~~an~~ subsequently received input-output
12 requests from ~~a the~~ host processors, and returning a completion report;

13 means for instructing an allocation change of the logical volumes storage area in
14 regard to the virtual volume to the other virtualization apparatus when receiving the completion
15 report from the other virtualization apparatus;

16 means for receiving the completion report of the allocation change from the other
17 virtualization apparatus; and

18 means for sending an instruction ~~for releasing the state of the input-output held~~
19 ~~temporarily~~ to the other virtualization apparatus for releasing the input-output request that are
20 being temporarily held.

1 16. (Original): A storage device according to claim 15, wherein there are
2 provided a configuration change control program for realizing each of the above means and a
3 processor that executes the program.

1 17. (Currently amended): A storage device according to claim 15, wherein
2 there is provided a copy control unit for copying data from logical volumes originally allocated
3 to a virtual volume to other logical volumes that are subsequently allocated to the virtual
4 volume ~~storage area to another storage area when the configuration is changed from the storage~~
5 ~~area that becomes an object of the allocation to the virtual volume to the other storage area.~~

1 18. (Currently amended): A change method for allocation of a plurality of
2 logical volumes storage area of a storage device to a virtual volume in a plurality of
3 virtualization apparatuses that process input-output from a plurality of host processors to the
4 virtual volume, comprising the steps of:

5 issuing, to the plurality of virtualization apparatuses, a request for temporarily
6 holding ~~the input-output requests processing that is~~ received from the host processors after a
7 certain point of time;

8 making the respective virtualization apparatuses change the allocation of the
9 logical volumes storage area of the storage device on the condition that a report indicating
10 completion of the processing of ~~the all~~ input-output requests is being processed in response to the
11 ~~request was received from the respective virtualization apparatuses; and~~

12 releasing input-output requests that are being temporarily held a state of the input-
13 output held temporarily after the completion report of the allocation change is received from the
14 respective virtualization apparatuses.

1 19. (Original): A change method according to claim 18, wherein the step of
2 inputting an instruction of a configuration change from a management console is included and
3 the request for temporarily holding the input-output is issued in accordance with the input
4 instruction.

1 20. (Currently amended): A program for a configuration change that changes
2 allocation of a plurality of logical volumes storage area of a storage device to a virtual volume in
3 a storage system including a plurality of virtualization apparatuses that allocate the logical
4 volumes a storage area which the storage device has; form a plurality of virtual volumes, and
5 process input-output from a host processor to one of the virtual volumes, comprising:

6 means for issuing, to the plurality of virtualization apparatuses, a request for
7 completing the all input-output requests received from the host processors that are being
8 processed by the virtualization apparatuses ~~received from the host processor~~ and temporarily
9 holding the any subsequently received input-output requests received from the host processors
10 ~~processing that is received subsequently;~~

11 means for receiving, from the plurality of virtualization apparatuses, a report
12 indicating completion of the processing of the input-output ~~being processed~~ request in response to
13 the request for completing;

14 means for instructing the allocation change of the logical volumes storage area of
15 the storage device to all the virtualization apparatuses when receiving the completion report from
16 all the virtualization apparatuses to which the request was issued;

17 means for receiving the completion report of the allocation change from all the
18 virtualization apparatuses; and
19 means for sending an instruction ~~for releasing a state of the input-output held~~
20 ~~temporarily~~ to all the virtualization apparatuses for releasing the input-output request that are
21 being temporarily held.